

ADDRESS

Delivered by the President, Professor Adams, on presenting the Gold Medal of the Society to Professor Heinrich D'Arrest.

It has been already announced to you that the Council have awarded the Society's Medal to Professor H. L. D'Arrest, Director of the Observatory of Copenhagen, for his Observations of Nebulæ contained in his *Resultate aus Beobachtungen der Nebelflecken und Sternhaufen* and in his later and much more extensive work, *Siderum Nebulosorum Observationes Harnienses*, as well as for his other recent astronomical labours. It now becomes my duty to lay before you the grounds of this award; and I feel confident that a plain statement of the nature and extent of the work accomplished by Professor D'Arrest will be sufficient to convince you that he richly deserves our medal.

Professor D'Arrest has been long well known for his contributions to our science. No reader of the *Astronomische Nachrichten* can fail to have been struck by the untiring activity shown by his numerous communications to that periodical, so indispensable to the astronomers of all countries. Among his discoveries I may refer to that of the interesting periodical comet which bears his name, and likewise to that of the minor planet *Freia*, the 76th member of the group of small planets between *Mars* and *Jupiter*, the known number of which now amounts to 142, and is yearly increasing at a rate which shows no signs of slackening.

But of all the labours of Professor D'Arrest, unquestionably the most important are his observations of nebulæ contained in the two works mentioned at the commencement of this address.

These works would, in the opinion of your Council, even if they stood alone, amply justify the award of your medal.

Nearly forty years have elapsed since the Society's medal was awarded to Sir John Herschel for his Catalogue of Nebulæ and Clusters of Stars, printed in the *Philosophical Transactions* for 1833. In his address on that occasion, the Astronomer Royal gave an able sketch of the history of our knowledge of the nebulæ up to that time, which makes it quite unnecessary for me to go over the same ground, necessarily much more feebly. I may merely recall that the three catalogues of Sir William Herschel, published in the *Philosophical Transactions* for 1786, 1789, and 1802, contain the places and descriptions of 2500 nebulæ and star-clusters. Sir John Herschel's catalogue contains the results of his observations made at Slough, with his 20-foot reflector, between the years 1825 and 1833. These observations were undertaken for the purpose of reviewing the

nebulae and star-clusters discovered by his father. The catalogue comprises 2307 of these objects, about 500 of which are new.

Not content with having made this survey of the heavens visible in this latitude, Sir John Herschel resolved to undertake a similar survey of the southern heavens; and for this purpose he transported to the Cape of Good Hope the same instrument which he had employed in the northern hemisphere, "so as to give a unity to the results of both portions of the survey, and to render them comparable with each other."

The observations required in order to carry out this grand plan were made in the years 1834, 1835, 1836, 1837, and 1838, and the fruits of these prolonged labours appeared in 1847, in the magnificent work, *Results of Astronomical Observations made at the Cape of Good Hope*. The survey included the double-stars of the southern hemisphere, as well as the nebulae and star-clusters. The work contains a catalogue of 1708 of these latter objects, entirely similar in its arrangement and construction to the Catalogue of Northern Nebulae in the *Philosophical Transactions* for 1833, and reduced to the same epoch (1830), in order to facilitate the union of the two catalogues into one general one. Of these objects 89 are common to the two catalogues, so that the number of distinct nebulae and clusters which they contain is 3926. Both of these works of Sir John Herschel contain engraved representations of some of the most remarkable nebulae, whether of typical or of exceptional form, by means of which future observers may be able to ascertain whether any secular changes are perceptible in them. The latter work also comprises valuable chapters on the apparent distribution of the nebulae over the heavens, and on their classification, together with many general remarks on the phenomena presented by them, which have been suggested by the author's long experience.

By these labours of Sir William and Sir John Herschel, and by them almost exclusively, astronomers had now obtained a considerable amount of knowledge respecting the apparent distribution of the nebulae over the heavens, and respecting their forms and physical structure as seen through powerful telescopes.

Their distances from us, however, and therefore their real distribution in space and their actual magnitudes remained matter of speculation only.

Sir William Herschel, having found that many nebulae, which in inferior instruments showed no traces of stellar composition, were, when viewed by his powerful telescopes, resolved entirely into stars, was at first inclined to believe that all nebulae were so resolvable. Hence he was inclined to regard them as so many galaxies, similar in their nature to our Milky Way, and owing their nebulous appearance to the enormously greater distances from us at which they were situated. Longer experience, however, induced him completely to change his views.

Already in 1791, in a paper on Nebulous Stars, he had arrived at the conclusion that there exists a diffused self-luminous matter

“in a state of modification very different from the construction of a sun or star,” and that a nebulous star is one “which is involved in a shining fluid of a nature totally unknown to us,” and “which seems more fit to produce a star by its condensation than to depend on the star for its existence.”

Again, in his paper on the Construction of the Heavens, in the *Philosophical Transactions* for 1811, he shows that although the appearances presented by diffused nebulous matter and by a star are so totally dissimilar, yet that these extremes may be connected by a series of such nearly allied intermediate steps as to make it highly probable that every succeeding state of the nebulous matter is the result of the action of gravitation upon it while in a foregoing one, and that by such steps the successive condensation of it has been brought up to the condition of planetary nebulae, and from this again to a stellar form.

From the appearances presented by the planetary nebulae he infers that the nebulous matter is partially opaque, since the superficial lustre which these objects exhibit could not result “if the nebulous matter had no other quality than that of shining, or had so little solidity as to be perfectly transparent.”

He also suggests that comets may be composed of nebulous matter in a highly condensed state, and that the faint nebulous branches which are often seen appended to a nucleus may be similar to the Zodiacal Light in relation to our Sun.

In the same paper he finds reason to conclude that the distance of the faintest part of the great nebula in *Orion* probably does not exceed that of stars of the 7th or 8th magnitude, but may be much less, perhaps even not exceeding the distance of stars of the 2nd or 3rd order, and consequently that “the most luminous appearance of this nebula must be supposed to be still nearer to us.”

These views of Sir William Herschel respecting the gradual formation and growth of stars by the condensation of nebulous matter were still further confirmed and developed in his paper in the *Philosophical Transactions* for 1814.

Sir John Herschel's graphic description of the two Nubeculae, or Magellanic clouds, likewise clearly shows that irresolvable nebulae, resolvable nebulae, and clusters of stars represent luminous matter in different conditions, but not necessarily at very different distances from us.

The direct measurement of the distance of a nebula by determining its annual parallax must be regarded as nearly hopeless. The nearest known fixed star has a parallax of scarcely one second. Now the error to which we are liable in the determination of the place of a nebula, although, as we shall see, it may under favourable circumstances be made much smaller than has been commonly supposed, still considerably exceeds one second. Hence, unless a nebula were much nearer to us than the nearest fixed star, there would be no chance of our being able to determine its parallax.

There is one method, however, by which we may expect ultimately to throw great light on the mutual relations of the nebular and sidereal systems, and on their relative distances from us: I mean by the study of their proper motions. Of course, no definite conclusion respecting the distance of an individual nebula could be drawn from the observation of its proper motion. For a nebula comparatively near to us might still have a very small proper motion, simply because its motion in space was nearly equal and parallel to our own. If a large number of instances, however, were taken, it might be asserted with a high degree of probability that those bodies which had a large proper motion were on an average nearer to us than those whose proper motion was small.

Now we know, at least approximately, the proper motions of many of the fixed stars, and materials are gradually accumulating which will give us a much more accurate and extensive knowledge respecting them; but of the proper motions of the nebulae we know little or nothing.

Unfortunately for this object, the instruments of Sir William Herschel were not well adapted for the very accurate determination of the places of nebulae. He himself estimates that after 1785 the uncertainty of his places might amount to $1\frac{1}{2}$ minute of space in R.A., and from $1\frac{1}{2}$ to 2 minutes in Declination, and that his earlier observations were liable to much greater errors. Hence these observations can scarcely be employed in such a delicate research as that of the determination of proper motions.

The degree of accuracy attained in Sir John Herschel's two catalogues is much greater. The author considers the probable error of a single observation in his northern catalogue not to exceed $1\frac{1}{2}$ second of time in R.A., and $30''$ in Declination. In his Cape Observations he estimates that the error of a single observation will seldom exceed $30''$ of space in the direction of the parallel, or $45''$ in that of the meridian.

Both of these catalogues give the results of the separate determinations of the place of a nebula, and therefore afford the means of calculating the probable errors of the observed places.

Professor D'Arrest has thus found that the probable error of a single position is nearly $15''$ in R.A. and $19''.5$ in Declination.

Considering the comparatively recent date of these observations, however, it is plain that a considerable time must elapse before the comparison of Sir John Herschel's observations with later ones of a similar degree of accuracy can be expected to yield trustworthy results respecting the proper motions of the nebulae.

M. Laugier was the first who attempted to determine the places of certain selected nebulae with much greater precision than is attained in Sir John Herschel's catalogues, in order that they might furnish a secure foundation to future investigations respecting proper motion. In the *Comptes Rendus* of December 12,

1853 (tome xxxvii. p. 874), he gives a catalogue of the places of 53 nebulae for the beginning of 1850, selecting such as had well-defined centres or points of greatest brilliancy. It is to be regretted that no details are given respecting either the number of observations on which the places in the catalogue are founded, the mode of observation, or the telescope employed, so that the catalogue itself affords us no means of judging of the degree of accuracy of the places contained in it.

Professor D'Arrest's first series of observations on the nebulae began in May 1855, and, like M. Laugier's, had for their object the accurate determination of positions for the express purpose of affording means in due time of studying the proper motions of the nebulae, and thence arriving at more certain conclusions respecting the relations between the nebular and sidereal systems than could be attained by the mere contemplation and examination of the objects themselves, even with the aid of the most powerful telescopes. The results of these observations were published in the *Transactions* of the Royal Saxon Society of Sciences for 1856. The number of nebulae observed amounts to 230. The observations were made at the Leipzig Observatory, of which Professor D'Arrest was then the Director, with the Fraunhofer refractor of $4\frac{1}{3}$ French inches in aperture and 6 feet focal length, by means of a Fraunhofer's double ring-micrometer. The magnifying power usually employed was 42 times. The nebulae were thus directly compared with neighbouring stars out of Bessel's and Argelander's Zones. In one night usually three and sometimes four transits of a nebula and its comparison-star were observed, the transits being taken alternately in the northern and southern halves of the ring-micrometer. In order to guard against the uncertainty which may still remain in the places of the stars of comparison, Professor D'Arrest often gives, in his description, the observed differences of right ascension and declination. He also often gives the position of the nebula with respect to the nearest stars, frequently those of the 10th and 11th magnitude, which must ultimately prove most useful for the determination of the nebula's proper motion. In this last point he followed the excellent practice of Sir John Herschel; but he was able to make more repeated measures of this kind, since, on account of the comparatively small power of the instrument, the description of the objects was of secondary importance. It should be remarked that all these measures were taken with the ring-micrometer, no mere estimations being admitted except when they are expressly mentioned. The results derived from each night's observations are given separately. The places given in the catalogues of Sir William and Sir John Herschel and in the small catalogue of Laugier are likewise reduced to the same epoch (1850) for the sake of comparison.

We are so much accustomed to think of the observations of nebulae in connection with the most powerful instruments, that it will be no doubt a matter of surprise that a refractor of scarcely

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4 $\frac{1}{2}$ inches aperture should have been found suitable for such work. Professor D'Arrest, however, from his experience with such an instrument, estimates that it is capable of showing nearly a thousand nebulae, that is about a third part of all that have been observed in our latitudes with the most powerful telescopes. He remarks also that the small nebulae of Herschel, mostly round or elliptical in form, can have their places determined more accurately than the majority of telescopic comets. Besides, in observing nebulae, there is the immense advantage of being able to repeat the observation of one and the same place on different nights. The prevailing central condensation in nebulae, which sometimes attains a degree of concentration almost stellar, and which very frequently offers a well-defined nucleus, gives a great degree of definiteness to the observation. Those nebulae which, for various reasons, cannot be observed accurately are, according to Professor D'Arrest, comparatively less numerous. Of the 53 nebulae observed by Laugier, 31 have been re-observed by Professor D'Arrest. Excluding one of Laugier's right ascensions, which is evidently affected with a large error, and three of the declinations, which appear to be about 1' in error, perhaps through mistakes in copying, and assuming the probable error of one of Laugier's positions to be equal to that of the mean of three of his own single positions, Professor D'Arrest finds each of these probable errors to be about 6'' both in right-ascension and declination. By a provisional calculation of the probable error of his observations, founded on a comparison of the several determinations with their mean, Professor D'Arrest finds that the probable error of a definitive position, that is of the mean of the observations of three nights, generally depending on 9 transits, does not exceed 4 or 5 seconds of space in each co-ordinate.

Professor D'Arrest makes an interesting use of his comparisons of his own places with those of Sir John Herschel. The mean epoch of Sir John Herschel's observations is nearly 25 years earlier than that of his own. Hence the difference between the places of a nebula as given by the two authorities, and reduced to the same epoch, will include not merely the errors of the observations, but also the proper motion for 25 years and the difference of the star-places used in the reductions. Now, from the probable errors of Sir John Herschel's and Professor D'Arrest's places which have been already ascertained, we can at once obtain the value of the mean of the squares of the differences between those places, supposing the differences to be entirely due to casual errors of observation. The actual mean of the squares of the differences is found to be greater than the above-mentioned mean, and the excess is due partly to the proper motions of the nebulae in the interval, partly to the differences in the star-places employed, and, very probably also partly to constant differences in the mode of observing the same nebula by the two observers. Hence Professor D'Arrest concludes

that the probable amount of the annual relative motion of the nebulae with respect to the sidereal system is less than $0''.4$ measured in arc of a great circle.

I may appropriately conclude my remarks on Professor D'Arrest's *Resultate aus Beobachtungen der Nebelflecken und Sternhaufen* by a quotation from one who has himself done much in the same line of research. Speaking of Laugier's and D'Arrest's observations, Dr. Schultz says: "These works have the high merit of having originated a new and important branch in the study of the nebulae; and D'Arrest has done especial service to this study by showing that, when what is required is simply good determinations of positions, a much greater number of nebulae than has been usually supposed may be advantageously observed with instruments of but very moderate dimensions. But his series of observations is chiefly and especially important as proving beyond the possibility of a doubt that the positions of nebulae in general are determinable with far greater accuracy than it had been previously usual to suppose; and D'Arrest's work thus made an epoch in the study of nebulae, by freeing it from the deterring prestige which had before that period been attached to it."

Many other observers have since followed up the work thus begun by Professor D'Arrest. Very accurate positions of nebulae have been observed by Auwers, Schmidt, Schönfeld, Vogel, Rümker, Stephan, Schultz, and others. I may particularly mention Schönfeld's Mannheim Observations of 235 Nebulae, which appear to be extremely accurate and are published in a form that leaves nothing to be desired. This work also enjoys the immense advantage that the places of all the stars of comparison have been newly determined by the meridian observations of Professor Argelander. But a still more extensive work in the same field, and which promises to attain even a greater degree of accuracy, is that by Dr. Schultz, from whom I have quoted above. This work consists of micrometrical observations of 500 nebulae made at the University Observatory of Upsala, with the Steinheil 13-foot refractor, employing a parallel wire-micrometer with bright spider-lines on a dark field.

By means of the various series of observations to which I have referred, future astronomers will be provided with a rich store of materials for the study of the proper motions of the nebulae, and we may hope that even in our own time some valuable results may be arrived at respecting them.

Professor D'Arrest's observations of nebulae were interrupted for a time by his appointment as Director of the Observatory of Copenhagen. In no long time, however, his new position gave him the opportunity of resuming his observations with the aid of greatly increased optical power. In the year 1861, the Observatory acquired a magnificent refractor, by Merz, of 15 feet focal length and $10\frac{1}{2}$ French inches in aperture, of which Professor D'Arrest has given an elaborate description in a separate publication, *De Instrumento magno æquatorio*. He considers

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 this instrument to be intermediate, as regards optical power, between Sir John Herschel's 20-foot reflector in its best condition, and the excellent telescope with which Mr. Lassell made his observations at Valletta. Finding that with this instrument he could not only perceive the very faintest of the nebulae discovered by the two Herschels, but could make sufficiently precise observations of them, he resolved no longer to continue the work begun in Leipzig, where he confined his attention to selected nebulae, but to enlarge his plan of operations and make a survey of the nebulae of the whole of the northern heavens. At first, indeed, it was his intention to observe all the nebulae he should meet with, whether previously known or not, with the utmost attainable precision, and that not once or twice only but repeatedly. He soon found, however, that to carry out such a plan, especially in such a climate, was beyond human powers, the number of the nebulae far exceeding all expectation. After labouring assiduously and perseveringly at these observations for more than six years, Professor D'Arrest was at length compelled by failing health to bring his work to a close. He estimates that in those six years he had not been able to make more than about one-eighth of the total number of observations which would be required in order to form a catalogue of the approximate positions of those nebulae which could be accurately observed with the Copenhagen refractor.

The results of these prolonged labours have been published in the great work, *Siderum Nebulosorum Observationes Havnienses*, 1867. This volume contains about 4800 single positions of 1942 different nebulae. Of these about 390 have either not been previously observed, or have not had their places determined. Sir John Herschel's Northern Catalogue of Nebulae and Clusters of Stars contains a larger number of objects, viz., about 2300. The difference between these numbers partly arises from the fact that D'Arrest has designedly omitted those objects in Herschel's catalogue which, in his judgment, should not be classed with the nebulae, viz., clusters and collections of stars belonging to Sir William Herschel's sixth, seventh, and eighth classes. These clusters appear to have no necessary connection with true nebulae, and they are distributed over the sphere in a totally different manner. The number of such clusters, especially near the Milky Way, might be easily greatly increased; and in making his sweeps, Professor D'Arrest has often been surprised to find certain clusters inserted in Herschel's catalogue, while several others in the same neighbourhood were omitted. The selection appears to him arbitrary and by no means natural. He thinks too that the introduction of these objects would tend to vitiate any inquiries into the law of distribution of the nebulae.

By far the greater number of the nebulae cannot be observed at all with bright wires, or at any rate can only be so observed by great expenditure of time and trouble. Hence Professor D'Arrest did not attempt to define their places with all the precision of which his instrument was capable, but brought each nebula into the

centre of the ring-micrometer, the smallest radius of which was $3' 40''$. The power employed in determining all these approximate positions was 123. The hour circle was read off to integral seconds of time, and the declination circle to tenths of a minute of arc.

In fact, nearly the same method was followed which astronomers are accustomed to employ in finding the places of very faint comets. Thus everything was scrupulously avoided which would interfere with the keenness of vision, and the more precise definition of place was generally left to micrometrical observations and comparisons with minute stars situated in the immediate neighbourhood of the nebula.

The nebulae were generally observed in zones of about 4° or 5° in breadth, and in each zone 4 or 5, or even sometimes 7 fixed stars of the 7th or 8th magnitude were included, whose places were taken from Bessel's or Argelander's zones, or sometimes from those of Lalande.

The work contains about 4000 micrometrical measures, chiefly made with the ring-micrometer. More rarely nebulae were compared with the stars and with each other by means of the wire-micrometer. Bright and small nebulae, having stellar nuclei, or at least an entirely regular form, were observed with all possible precision, and the differential determinations of their positions referred to neighbouring stars will, without doubt, be found of the greatest importance in the future study of their proper motions.

Excluding a few nebulae, whose places do not admit of any accurate determination, Professor D'Arrest finds, from 1627 observations of declination of 525 nebulae, that the probable error of a single observation of declination is $17''.58$, while from 1552 right ascension observations of 497 nebulae, he finds the probable error of a single observation of right ascension to be $0^s.809 \text{ sec } \delta$.

These probable errors are slightly less than the corresponding probable errors of Sir John Herschel's catalogues.

Following the excellent example set by Sir John Herschel, Professor D'Arrest gives the results of each night's observations of a nebula separately, both as regards its place and its description.

The use of an equatorially mounted telescope has no doubt rendered this catalogue comparatively free from incidental errors and mistakes in the identification of nebulae, which will occasionally happen, in spite of the greatest care, when the observations are made with an instrument not so mounted.

Lord Rosse's valuable selection from the observations of nebulae made with his gigantic reflector of 6-feet aperture appeared in the *Philosophical Transactions* for 1861, but, curiously enough, did not reach Professor D'Arrest's hands till 1864, when his own work was considerably advanced. This work contains sometimes brief and sometimes full descriptions of about 800 nebulae, many of them being illustrated by figures. Professor D'Arrest found that not a few of the nebulae which he had detected in the interval between

1861 and 1864 had been already observed by Lord Rosse and his assistants, and that his descriptions were generally confirmed by theirs. Very many "new" nebulae, however, still remained which had not been observed by Lord Rosse; while, on the other hand, many which occur in Lord Rosse's work had escaped the notice of Professor D'Arrest. After this period he derived the greatest assistance from Lord Rosse's work. It is not surprising to find occasional differences and discrepancies in the descriptions of nebulae given in these two works. Professor D'Arrest mentions that he has found and observed by far the greater part of those nebulae which had been observed by Herschel, but had been inserted by Lord Rosse in a list of "nebulae not found."

He also succeeded in verifying the existence and determining the places of many very faint nebulae, which had been first discovered by means of Lord Rosse's telescope.

In the *Philosophical Transactions* for 1864, Sir John Herschel published his *General Catalogue of Nebulae and Clusters of Stars*, and thereby laid astronomers under another very heavy obligation. This excellent catalogue contains all the nebulae and clusters of stars, both northern and southern, actually known at that date, 5063 in number, arranged in order of right ascension, and reduced to the common epoch 1860. A short description of each nebula or cluster is given in abbreviated words, made out from an assemblage and comparison of all the descriptions of each object given in his father's and in his own observations.

It is not easy to over-estimate the boon which such a catalogue offers to an observer of nebulae, by enabling him "at once to turn his instrument on any one of them, as well as to put it in his power immediately to ascertain whether any object of this nature which he may encounter in his observations is new, or should be set down as one previously observed." As Sir John Herschel remarks, "For want of such a general catalogue, a great many nebulae have been from time to time, in the *Astronomische Nachrichten* and elsewhere, introduced to the world as new discoveries, which have since been identified with nebulae already described and well known. Many a supposed comet, too, would have been recognised at once as a nebula, had such a general catalogue been at hand, and much valuable time been thus saved to their observers in looking out for them again."

While Sir John Herschel was engaged in the preparation of this catalogue, an important work by Dr. Auwers appeared, entitled, *William Herschel's Verzeichnisse von Nebelflecken und Sternhaufen, bearbeitet von Arthur Auwers*, Königsberg, 1862. This contains a complete and most elaborate reduction to 1830, from the observed differences in right ascension and polar distance with known stars, recorded in the *Philosophical Transactions*, of all the nebulae and clusters in Sir William Herschel's three catalogues; together with a separate catalogue of all those collected by Messier from his own observations or those of Méchain and others (101 in number), similarly reduced; another

of Lacaille's southern nebulae; and one of fifty "new nebulae, comprising nearly all those observed by other astronomers (Lord Rosse excepted) in this hemisphere, all brought up to the same epoch."

Sir John Herschel states that a comparison with Dr. Auwers' results led him to the detection of several grave errors in his own work which would otherwise have escaped notice, and whose rectification has added materially to its value.

Sir John Herschel's general catalogue contains the places and descriptions of 125 of the new nebulae discovered by Professor D'Arrest, and reduced by him to the epoch of that catalogue.

At the end of his own work Professor D'Arrest gives a catalogue of the mean places of his 1942 nebulae, reduced to the epoch 1860 for comparison with Herschel's general catalogue. He also gives a comparison of his own positions with the places of 223 nebulae contained in the very accurate special catalogue by Schönfeld, which has been already mentioned.

In the above rapid sketch I have omitted to mention the many excellent descriptions and delineations of particular nebulae which we owe to Mr. Lassell, Professors W. C. Bond and G. P. Bond, Mr. Mason, Otto von Struve, Padre Secchi, and others.

I must not terminate this very imperfect account of the principal additions to our knowledge of the Nebulae which have been made in recent years, without referring to the entirely new mode of investigation to which they have been subjected by means of the spectroscope. By observations of this kind, Mr. Huggins and others have thrown much additional light on the nature and constitution of these mysterious bodies. Already the spectra of about 140 nebulae have been examined, and the light from many of them has been proved to emanate from glowing gas. This entirely confirms the mature view of Sir William Herschel, viz., that the condition of the luminous matter in many of the nebulae is widely different from its condition in the fixed stars.

Professor D'Arrest has himself contributed to the spectroscopic observations of the nebulae, and he has made the suggestive remark, that almost all the gaseous nebulae are found either within or near the borders of the Milky Way, and that there is an entire absence of them in the regions near the poles of the galaxy, in which the other nebulae so abound. I believe that a similar remark was made about the same time by Mr. Proctor.

It is worth mentioning that one of the most remarkable of these gaseous nebulae, viz. the planetary nebula numbered 4373 in Sir John Herschel's General Catalogue was observed as a fixed star by Lalande in 1790, and that by comparing its place so determined with the very accurate modern determinations of Schönfeld, D'Arrest, and others, it has been shown that the proper motion of this nebula is quite insensible.

I trust that the statement, however bald and imperfect, which I have just laid before you respecting the labours of Professor D'Arrest, will have convinced you that your Council have been fully justified in awarding to him the Society's medal.

The President then, delivering the Medal to the Foreign Secretary, addressed him in the following terms :

Mr. Huggins—In transmitting this medal to Professor D'Arrest, you will express to him the admiration we feel for the skill and perseverance which he has shown in his observations of the nebulae, and our high appreciation of the value of his labours. You may assure him of our ardent wishes that health and strength may long be spared to him, so that he may be able to make many further contributions to the progress of Astronomy.

The Meeting then proceeded to the election of the Officers and Council for the ensuing year, when the following Fellows were elected :—

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J. C. ADAMS, Esq., M.A., F.R.S., Lowndean Professor of Astronomy, Cambridge.

Vice-Presidents.

ARTHUR CAYLEY, Esq., M.A., F.R.S., Sadlerian Professor of Geometry, Cambridge.

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Rev. CHARLES PRITCHARD, M.A., F.R.S., Savilian Professor of Astronomy, Oxford.

Captain G. L. TUPMAN, R.M.A.

J. MAURICE WILSON, Esq., M.A.